Force Structure Matters: The US Field Artillery in Operational Art

A Monograph

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In 2014, the US Forces Command (FORSCOM) implemented the activation of the division artillery (DIVARTY) and field artillery (FA) brigade force structure. This monograph analyzes the effectiveness of the US Field Artillery force structure and the ability to meet the required capabilities that enable commanders to exercise operational art. First, the monograph evaluates the fires capability requirements outlined in the US Army capstone concepts and assesses the effectiveness of the surface-to-surface indirect fire systems available in achieving the requirements. Then the monograph assesses how the field artillery enables operational art and Unified Land Operations (ULO) through the evaluation of specific elements of operational art and tenets of ULO. The monograph then analyzes two case studies, Operation Desert Storm and Operation Anaconda, to highlight the utility of artillery in operational art while also addressing limitations and planning considerations. The monograph concludes with an analysis of the US Field Artillery force structure in achieving the fires capability requirements. The change in the FA force structure is a step in the right direction for re-establishing the essential conduit for the integration and synchronization of fires assets, but the DIVARTYs lack the organic artillery systems necessary to provide operational fires and effectively shape the operational environment for the division. The monograph recommends providing an organic rocket FA battery to each DIVARTY and establishing composite FA battalions throughout the US Army. The recommendations enhance a commander's ability to exercise operational art, provide greater flexibility in the employment of fires, and increase the firepower of the unit.

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Abstract

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In 2014, the US Forces Command (FORSCOM) implemented the activation of the division artillery (DIVARTY) and field artillery (FA) brigade force structure. The purpose for the implementation was to establish command relationships to exemplify mission command that produced trained and ready FA units capable of providing synchronized strategic, operational, and tactical level effects in support of combined arms maneuver and wide area security. This monograph analyzes the effectiveness of the US Field Artillery force structure and the ability to meet the required capabilities that enable commanders to exercise operational art.

First, the monograph evaluates the fires capability requirements outlined in the US Army capstone concepts. The monograph assesses the effectiveness of the surface-to-surface indirect fire systems available in achieving the capability requirements and identifies any shortfalls. Then the monograph assesses how the field artillery enables operational art and Unified Land Operations (ULO) through the evaluation of specific elements of operational art and tenets of ULO. The monograph then analyzes two case studies, Operation Desert Storm and Operation Anaconda. Operation Desert Storm was a demonstration of the successful employment of artillery and how the artillery enables operational art. Conversely, Operation Anaconda involved no US artillery although the adversary possessed indirect fire capabilities. The use of the case studies highlight the utility of the artillery in operational art while also addressing limitations and planning considerations.

The monograph concludes with an analysis of the US Field Artillery force structure in achieving the fires capability requirements. The change in the FA force structure is a step in the right direction for re-establishing the essential conduit for the integration and synchronization of fires assets, but the DIVARTYs lack the organic artillery systems necessary to provide operational fires and effectively shape the operational environment for the division. The monograph recommends providing an organic rocket FA battery to each DIVARTY and establishing composite FA battalions throughout the US Army. The recommendations enhance a commander's ability to exercise operational art, provide greater flexibility in the employment of fires, and increase the firepower of the unit.

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Acronyms

ACC	Army Capstone Concept
ADRP	Army Doctrine Reference Publication
AOC	Army Operating Concept
APMI	Advanced Precision Mortar Initiative
ATACMS	Army Tactical Missile System
ATO	Afghanistan Theater of Operations
BCT	Brigade Combat Team
BG	Brigadier General
CAS	Close Air Support
CEP	Circular Error Probable
CJTF	Coalition Joint Task Force
COIN	Counterinsurgency
DIVARTY	Division Artillery
FA	Field Artillery
FDU	Force Design Update
FORSCOM	United States Forces Command
GEN	General
GMLRS	Guided Multiple Launch Rocket System
HIMARS	High Mobility Artillery Rocket System
HLZ	Helicopter Landing Zone
IBCT	Infantry Brigade Combat Team
JTF	Joint Task Force
MG	Major General
MLRS	Multiple Launch Rocket System
OIF	Operation Iraqi Freedom

OEF	Operation Enduring Freedom
PAA	Position Area for Artillery
PGK	Precision Guidance Kit
PGM	Precision Guided Munitions
SOF	Special Operations Forces
TRADOC	United States Army Training and Doctrine Command
ULO	Unified Land Operations
USAFAS	United States Army Field Artillery School

Introduction

> As we move into the second century of field artillery, the path ahead will become increasingly difficult, but increasingly vital.
>
> —GEN Raymond T. Odierno[1]

The US Field Artillery (FA) is in a pivotal period of transition after more than a decade of conflict. In 2003, the Army experienced a transformation in the force structure to support modularity. The principle tactical unit of the modular Army was the combined arms maneuver brigade serving as the unit of action. The combined arms maneuver brigade consisted of combined arms maneuver, fires, intelligence, reconnaissance, and logistics units to be self-contained. The intent of the transformation was to shift from a division-based force to a tailorable brigade-based force capable of responding rapidly and effectively to various threats.[2]

Because of modularity, the FA experienced significant changes to the force structure. The modular brigade combat team (BCT) structure included an FA battalion to provide maneuver commanders the capability of delivering responsive fires to support the brigade. Additionally, the FA brigade served as a functional brigade designed to support the BCTs, divisions, corps, or joint task forces (JTF). The concept eliminated the division artillery (DIVARTY) that served as the senior FA headquarters responsible for maintaining the relationship with corps, in addition to the training and readiness of the FA battalions. The assumption was that the BCTs could provide the adequate training, readiness, and administrative oversight to their organic FA battalions.[3]

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[1] Keith Pannell, "Odierno Celebrates Past, Future of Field Artillery During Ceremony," *Special to American Forces Press Service*, May 20, 2011, accessed February 5, 2015, http://www.defense.gov/news/newsarticle.aspx?id=64025.

[2] Boyd L. Dastrup, *US Army Field Artillery Center and Fort Sill Annual Command History: 1 January 2003 through 31 December 2003* (Fort Sill, OK: US Army Field Artillery Center, 2004), 62-63.

[3] Sean Bateman and Steven Hady, "King of Battle Once Again: An Organizational Design to Effectively Integrate Fires in Support of the Tactical, Operational and Strategic Force," *Fires* (March-April 2013): 23.

However, after a decade of conflict, this resulted in the atrophy of FA specific skills and ineffectiveness of the field artillery.

A turning point that highlighted the US Field Artillery's deficiencies was the publication of "The King and I," written by Sean MacFarland, Michael Shields, and Jeffrey Snow. All three authors served as brigade commanders in combat and witnessed the deterioration of the FA branch. The authors explained, "No branch of the Army has suffered a greater identity crisis than Field Artillery, as a result of transformation, COIN-centric operations, and the non-standard manpower demands of OIF/OEF."[4] Furthermore, the authors believed that it was urgent to review the structure of the US Field Artillery to improve the deficiencies by integrating fires with maneuver.[5] The paper analyzed the trends from the combat training centers to illustrate the inefficiencies and inability of the artillery to provide fire support to maneuver commanders. The paper gained widespread attention by the FA community and by senior leaders in the Army. Consequently, the paper generated sufficient discourse as senior Army leaders understood the issues of maintaining the field artillery core competencies and the necessity for improvement.[6]

To mitigate the deficiencies and the inability to integrate and synchronize fires effectively, MG James McDonald, Commanding General of the Fires Center of Excellence, submitted a force design update (FDU) to the Army in December 2012 to re-establish the FA command headquarters at the division and corps levels. The proposal established a DIVARTY to each active component division and a FA brigade to each active component corps to include one

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[4] Sean MacFarland, Michael Shields, and Jeffrey Snow, "White Paper: The King and I: The Impending Crisis in Field Artillery's ability to provide Fire Support to Maneuver Commanders," Memorandum sent to the Chief of Staff of the Army, 2007, 1.

[5] Ibid.

[6] William B. Caldwell, "Remarks at the Fires Seminar," Fort Sill, OK, June 3, 2008, 8; Michael J. Hartig, "The Future of the Field Artillery," Strategy Research Project (Carlisle Barracks, PA: US Army War College, 2010), 2.

FA brigade with US Eighth Army in Korea. The purpose of the implementation was to "provide FA capabilities (planning, synchronization, and coordination) to execute operational and tactical fires in support of ULO and to provide effective mission command for the training and readiness of attached FA units."[7]

However, there is a large distinction between the pre-modularity DIVARTY and the current DIVARTYs outlined in the FDU. The main distinction entails composition and structure of the DIVARTY. The force structure of the DIVARTY prior to modularity consisted of a mix of cannons and rockets to support the division. Conversely, the current DIVARTY has no organic firing units. The FA battalions remain organic to the BCTs within the divisions and are only attached to the DIVARTY. This distinction is relevant because the DIVARTY only possesses administrative and training oversight over the FA battalions while the BCT retains operational control. Although the DIVARTY may be allocated or task organized with additional units based on mission requirements, the DIVARTY only consists of a headquarters and headquarters battery, a signal platoon, and a target acquisition platoon. As stated in the implementation order, "the DIVARTY will play a key role to reverse the continuing atrophy of FA skills, halt the erosion of professional and leader development in the Fires Warfighting Function, and restore the art and science of synchronizing effects."[8] Therefore, the primary role of the DIVARTY is to ensure readiness and provide training oversight to the attached FA battalions. Although the DIVARTY significantly improves the field artillery as a whole, the current structure does not increase the firepower of the division with additional indirect fire assets. The DIVARTY does not possess organic FA cannon or rocket battalions and must rely on the corps' FA brigade, air force assets,

[7] US Army Forces Command, *US Army Forces Command Division Artillery (DIVARTY) Implementation Order,* April 9, 2014, Fort Bragg, NC, 2.

[8] Ibid.

the division's attack aviation assets, or the BCT's FA battalions to provide fire support for the division.

In light of the recent changes to the artillery, does the current US Field Artillery force structure meet the required capabilities that enable commanders to exercise operational art? To answer the question, Section One of this monograph will evaluate the fires capability requirements outlined in the US Army capstone concepts. The section will also assess the effectiveness of the surface-to-surface indirect fire systems available in achieving the capability requirements and identify any shortfalls. Section Two will address how the field artillery enables operational art and Unified Land Operations (ULO) through the evaluation of specific elements of operational art and tenets of ULO. Section Three will be a case study of Operation Desert Storm that demonstrated the successful employment of artillery and how the artillery enabled operational art. Conversely, Section Four will be a case study of Operation Anaconda, which involved no US artillery. Rather, the Joint Task Force relied solely on mortars and close air support to provide indirect fire support throughout the operation. The use of the case studies will highlight the utility of the artillery in operational art while also addressing limitations and planning considerations. The monograph will conclude with potential shortfalls and presents recommendations for further analysis. The first area analyzed is the fires capability requirements to understand whether the requirements are attainable with the current US Field Artillery force structure.

Fires Capability Requirements

The US Army Capstone Concept (ACC) describes the anticipated future operational environment and the broad capabilities the Army will require to accomplish its enduring missions. *The Army Operating Concept* (AOC) also provides a conceptual framework for Army

leaders to develop concepts to identify additional capabilities required for the future force to accomplish missions across the range of military operations.[9] The fires capability requirements outlined in the Army concepts provide a foundation for understanding the future role of artillery and validate the organizational structure and indirect fire systems of the US Field Artillery.

To meet the fires capability requirements outlined in the ACC, the *US Army Functional Concept for Fires* details the requisite for operational adaptive fires. Operational adaptive fires match a wide range of sensors to targets to achieve desired effects. Operational adaptive fires provide the Army with versatile capabilities to effectively respond and defeat a wide range of threats. The employment of versatile fires capabilities address the requirements for adaptable offensive and defensive fires for combined arms, joint, and multinational operations. A wide range of precision to conventional lethal and nonlethal capabilities provides the means for the employment of fires across the spectrum of conflict under a wide range of conditions.[10]

The ACC identifies two capabilities for the Fires Warfighting Function. The first requirement is the "capability to access and authorize the employment of joint multinational fires to support operations over wide areas in complex terrain to enable commanders to gain, maintain, and exploit positions of advantage in support of unified action."[11] The second requirement entails "offensive and defensive fires capabilities to deter, disrupt, degrade, or destroy threat capabilities, pre-empt enemy actions, and protect friendly forces and other critical assets abroad and in the

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[9] US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 535-3-0, *The US Army Capstone Concept* (Fort Eustis, VA: Department of the Army, 2012), 24; US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 525-3-1, *The US Army Operating Concept: Win In a Complex World* (Fort Eustis, VA: Department of the Army, 2014), 30.

[10] US Army Training and Doctrine Command (TRADOC), TRADOC Pamphlet 525-3-4, *The US Army Functional Concept for Fires* (Fort Eustis, VA: Department of the Army, 2010), 9-10.

[11] TRADOC, TRADOC Pam 535-3-0, 30.

homeland in support of unified action."[12] This section addresses the latter capabilities outlined in the Army concepts, the relevance of precision fires, and the impact on the organizational structure of the US Field Artillery.

Defining key terminology within the fires capability requirement generates an understanding of the type of indirect fire systems necessary to accomplish the different missions. The second fires capability requirement describes the capability in terms of the type and effects of fires. There are two types of fires: offensive and defensive. *The US Army Functional Concept for Fires* distinguishes the type of fires by their purpose. Offensive fires preempt enemy actions and defensive fires protect friendly forces, population centers, and critical infrastructure. Fires tasks that support offensive fires include preparation fires, close support fires, interdiction, electronic attack, early warning engagement, and counterfires. Whereas, fires tasks that support defensive fires include counterfire and final protective fires. The US Army requires the field artillery to maintain the capability of providing offensive and defensive fires to address the wide range of threats in future operational environments.[13]

The fires capability requirement outlined in the ACC requires offensive and defensive fires to "deter, disrupt, degrade, or destroy threat capabilities."[14] Deter is the ability to prevent an adversary's action by discouraging the opponent from changing its behavior. A form of

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[12] TRADOC, TRADOC Pam 535-3-0, 30.

[13] TRADOC, TRADOC Pam 525-3-4, 11; Department of the Army, Army Doctrine Reference Publication (ADRP) 3-09, *Fires* (Washington, DC: Government Printing Office, 2012), 1-6.

[14] TRADOC, TRADOC PAM 535-3-0, 30. The definitions for deter, disrupt, degrade, and destroy vary between civilians, military personnel, and among the different US Armed Services. For the purpose of this monograph, the author used joint and US Army doctrine to define these terms.

deterrence is the threat of retaliation.[15] Disrupt is the ability to "interrupt or impede enemy or adversary capabilities or systems, upsetting the flow of information, operational tempo, effective interaction, or cohesion of the enemy force or those systems."[16] Degrade is the ability to "reduce the effectiveness or efficiency of adversary command and control systems and information collection efforts or means" using lethal, nonlethal, or temporary means.[17] Destroy is the ability to render an adversary combat ineffective by targeting and damaging the systems or material where it cannot perform any function or be restored.[18] The amount of damage necessary to render a unit combat ineffective also depends on the unit's type, discipline, and moral.[19] Deter, disrupt, degrade, and destroy are effects and targeting objectives achievable through the employment of offensive and defensive fires.

As part of the versatile fires capabilities outlined in the *US Army Functional Concept for Fires*, the ability to employ multiple means to achieve the right effects and minimize or eliminate unintended consequences and residual hazards is imperative. To do so, indirect fires require a wide range of conventional to precision capabilities providing effects from precision, near-precision, and area effects. The US Army uses a circular error probable (CEP) to differentiate the effects. A CEP is the radius of a circle centered on a target encompassing an area where fifty percent of the rounds will land. The CEP is a means to determine the accuracy of a specific

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[15] US Joint Forces Command, Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms* (Washington, DC: Government Printing Office, 2010), 73; Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press, 1996), 4; For more information on military deterrence, see Robert J. Art, "To What Ends Military Power?" *International Security* 4, no. 4 (Spring 1980): 6.

[16] US Joint Forces Command, Joint Publication 3-03, *Joint Interdiction* (Washington, DC: Government Printing Office, 2011), viii.

[17] US Army Field Artillery School (USAFAS), "White Paper: Fire Support Planning for the BCT and Below" (Fort Sill, OK: United States Army Field Artillery School, 2009), 55.

[18] Army, ADRP 3-09, 1-2.

[19] USAFAS, "Fire Support Planning," 55.

munition and the delivery accuracy of a weapon system.[20] A smaller CEP implies greater accuracy while a larger CEP corresponds to less accuracy. The US Army also uses the CEP to determine the probable damage to a target. Understanding of the CEP is important to achieve the appropriate effects on a target while considering the accuracy of the munition and weapon system to determine potential collateral damage. The *US Army Functional Concept for Fires* defines precision capabilities having a CEP less than ten meters, near-precision fires with a CEP less than fifty meters, and area capabilities with a CEP greater than fifty meters.[21] The variance in CEP is one of the key differences among the suite of conventional munitions and precision munitions.

Conventional munitions are inherently less accurate because the lack of aid enhancements to guide a projectile on a target. Because of the limited accuracy, conventional munitions require larger volumes of munitions across multiple systems to achieve the desired effect. Conversely, precision munitions use guidance and control aids to correct for ballistic conditions. Precision munitions possess the capability to achieve desired effects on a specific target through the employment of one round. The accuracy and limiting effects make precision munitions ideal in an urban or complex environment due to the ability to mitigate collateral damage. However, there are additional requirements to consider when employing precision munitions.

An important requirement is providing an accurate target location. Because precision munitions are more accurate and have a smaller CEP, the employment requires greater accuracy for the target location. Precision munitions are only as accurate as the location provided by the observers or target acquisition systems. Since there is a reliance on providing an accurate target

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[20] William Nelson, "Use of Circular Error Probability in Target Detection" (Hanscom Air Force Base, MA: Electronic Systems Division, US Air Force, 1988), 1; TRADOC PAM 525-3-4, 57.

[21] TRADOC, TRADOC PAM 525-3-4, 12.

location, target coordinates and associated target location error need to be of a sufficient accuracy to achieve the desired effects. Most precision munitions require mensurated grid coordinates with a target location error of less than six meters.[22] Target coordinate mensuration is the process of determining an absolute latitude, longitude, and height.[23] This requirement involves trained observers using emerging technology and software to provide an enhanced and precise target location.

Another requirement to consider when employing precision fires is the ammunition and systems available. Currently, there are four precision-guided munitions available to provide precision fires. Multiple Launch Rocket System (MLRS) and High Mobility Artillery Rocket System (HIMARS) possess the capability to conduct precision deep strikes through the employment of the Army Tactical Missile System (ATACMS) and Guided-MLRS (GMLRS) rockets. Corps and divisions use ATACMS and GMLRS to shape deep operations, but can also support tactical operations. The more common and abundant precision guided munition at the operational and tactical level is the Excalibur. The Excalibur is a GPS-aided 155mm projectile. The M109A6 self-propelled howitzer and M777A2 towed howitzer are the only howitzers currently capable of delivering Excalibur munitions. Also at the tactical level, technological developments facilitated the production of precision mortars. The Advanced Precision Mortar Initiative (APMI) provides tactical commanders the ability to employ precision fires using the 120mm mortar systems. The ATACMS, GMLRS, Excalibur, and APMI are munitions to support precision accuracy at the operational and tactical levels.

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[22] Cal A. Thomas and Jonathan S. Delong, "Regaining our Luster: How Fort Sill Institutional Training Is Improving To Meet Requirements for the 21st Century Field Artillery NCO," *Redleg Update: The US Army Field Artillery Branch's Newsletter* (August 2014): 6.

[23] Department of the Army, Field Manual 3-09, *Field Artillery Operations and Fire Support* (Washington, DC: Department of the Army, 2014), 1-41.

To support near-precision accuracy, a Precision Guidance Kit (PGK) exists to incorporate the existing stock of munitions and enabling a smaller logistical footprint. The PGK is a near-precision fuze attached to a conventional projectile. The PGK uses GPS technology to correct the trajectory of the projectile inflight and is capable of achieving a CEP of less than fifty meters.[24] The PGK differs from a PGM because it is course correcting, rather than coordinate seeking. Currently, PGKs only support specific 155mm high explosive projectiles and are compatible with the M109A6 and M777A2 howitzers.

The *US Army Functional Concept for Fires* also addresses the capability to mass in space and time with precision, near-precision, and area effects.[25] Given the requirement to provide precision and near-precision effects, the only compatible indirect fire weapon systems that support this requirement are the MLRS/HIMARS, M109A6, M777A2, and the 120mm mortar variants. Presently, the M119A3 is the only indirect fire system that cannot support this capability requirement. As a result, the Infantry Brigade Combat Teams (IBCT) have composite FA battalions, composed of one M777A2 battery and two M119A3 batteries to provide precision and near-precision capabilities.

The current indirect fire systems the Army possesses can create the desired effects to deter, degrade, disrupt, and destroy. However, the volume of fires and types of munition differ to achieve these effects. The MLRS/HIMARS provide the capability to conduct deep strikes and effectively shape the operational environment. The rocket systems possess the range and munitions to achieve desired effects while also possessing the capability to deliver precision and near-precision effects. The MLRS/HIMARS are organic to the FA brigades that align with the active Army corps. Although the FA brigades can deploy as battalion or battery formations, the

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[24] Thomas and Delong, “Regaining Our Luster,” 6.

[25] TRADOC, TRADOC PAM 525-3-4, 12.

rocket systems are a high commodity enabler at the corps echelon providing greater range, accuracy, and lethality than other indirect fire systems.

The DIVARTYs also enable field artillery battalions to support operational and tactical fires.[26] The indirect fire weapon systems vary between the Armored, Stryker, and Infantry Brigade Combat Teams. Despite the differences, the FA battalions possess the capability to achieve the desired effects within the range of the organic indirect fire weapon systems. However, without the composite field artillery battalions assigned to the IBCTs, the brigade would not be able to achieve precision and near-precision effects.

The Advanced Precision Mortar Initiative facilitates more robust indirect fire capabilities to support maneuver commanders at the tactical level. The 120mm mortars are organic to the maneuver battalions to support close operations. The APMI provides a responsive precision capability without requiring support from units outside of the organization. The accuracy of the APMI also enables a smaller logistical footprint because mortars require less rounds to achieve desired effects. However, the maximum range for mortars is less than half of the tube artillery and cannot effectively shape the operational environment beyond the close operations.

Given the current artillery systems the Army possesses, the US Field Artillery is capable of achieving the fires capability requirements outlined in the Army concepts. However, the FA battalions are constrained by the maximum effective range of their respective artillery systems and munitions available. Additionally, not all systems can support the precision and near-

[26] The transition from the Joint Force Air Component Command (JFACC) fight to the air-ground integration fight distinguishes operational fires. Operational fires integrate Army Field Artillery (surface-to-surface) fires with joint and multi-national capabilities but could be conducted by any combination of available fires assets. For more information regarding operational level fires see US Army Field Artillery School, "DIVARTY: A Force Multiplier for BCT and Division," April 30, 2014, Fort Sill, OK, accessed February 5, 2015, http://sill-www.army.mil/USAFAS/DIVARTY.html.

precision effects. Thus, a synergy of all indirect fires assets is required to effectively achieve the fires capability requirements outlined in the Army concepts.

Artillery in Operational Art and ULO

Over the last decade, the relevance of artillery has diminished. What was once a decisive arm on the battlefield is now questionable. Johnathan Bailey noted that in times of war, the commander always demand more artillery than allocated and conversely, in times of peace, the value of artillery and lessons learned throughout history wither away.[27] Despite being in multiple conflicts over the last decade, the value of artillery waned due to the limited roles during stability operations and the nonstandard mission assigned to artillery units. To gain a greater appreciation of the value of artillery, this section addresses how the US Field Artillery enables commanders to exercise operational art in Unified Land Operations.

Army Doctrine Reference Publication (ADRP) 3-0, *Unified Land Operations*, defines operational art as "the pursuit of strategic objectives, in whole or in part, through the arrangement of tactical actions in time, space, and purpose."[28] ADRP 3-0 also specifies different elements to describe and evaluate operational art. The three elements of operational art most related to artillery are operational reach, tempo, and phasing. Additionally, the ADRP 3-0 characterizes Army operations into six tenets. The tenets of Unified Land Operations that artillery impacts most are flexibility, lethality, and depth.

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[27] J.B.A. Bailey, *Field Artillery and Firepower* (Oxford: Routledge, 1989), iii. Johnathan Bailey served as an artillery officer in the Royal Artillery achieving the rank of Major General before retiring in 2005. He served in the Falklands, Northern Ireland, Rhodesia, and Kosovo. His vast experience of conventional operations coupled with his professional interest in artillery history and technological developments led to his research and writing the book while serving in the Royal Artillery.

[28] Department of the Army, Army Doctrine Reference Publication (ADRP) 3-0, *Unified Land Operations* (Washington, DC: Government Printing Office, 2012), 4-1.

Operational reach is the distance and duration that a joint force can successfully employ military capabilities.[29] Endurance, momentum, and protection are subcomponents of operational reach. Artillery influences all three subcomponents during major combat operations. Endurance is the ability to project and employ forces for a protracted duration. Momentum stems from seizing the initiative and executing high tempo operations to overwhelm the enemy. Protection enables the commander to preserve combat power in order to have endurance and maintain momentum.[30] Within these subcomponents, artillery enables operational reach by providing extended range capabilities, enabling freedom of action, and reinforcing protection.

Artillery enables operational reach by providing extended range capabilities beyond the range of direct fire weapon systems. Artillery originally developed as a means to engage the enemy at longer ranges with a greater effective weight of fire than the infantry or cavalry.[31] Artillery provides the capability to engage targets beyond the forward line of troops and target enemy capabilities. The artillery rocket systems possess the capability to range targets up to forty-two kilometers with guided and unguided projectiles and up to three hundred kilometers using the ATACMS.[32] The 155mm howitzers also provide the capability to range targets up to forty kilometers and the 105mm howitzers ranging targets up to nineteen kilometers.[33] The artillery capabilities afford a commander the ability to maintain momentum by concentrating and striking targets in depth and enabling high tempo operations.

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[29] Joint Forces Command, JP 1-02, 190; Joint Forces Command, JP 3-0, III-28.

[30] Army, ADRP 3-0, 4-6.

[31] Bailey, *Field Artillery and Firepower*, 5.

[32] Lockheed Martin, "ATACMS: Long-Range Precision Tactical Missile System," (2011), accessed on December 12, 2014, http://www.lockheedmartin.com/content/dam/ lockheed/data/mfc/pc/atacms-block-1a-unitary/mfc-atacms-block-1a-unitary-pc.pdf.

[33] Operational Test and Evaluation Office of the Secretary of Defense, "Excalibur XM982 Precision Engagement Projectiles," 2007, accessed on December 12, 2014, http://www.dote.osd.mil/pub/ reports/FY2007/pdf/army/2007excalibur.pdf.

In addition, the field artillery facilitates freedom of action within a force's operational reach. By targeting in depth, the artillery provides greater protection over a larger area for the commander to arrange tactical actions in time, space, and purpose. The artillery also facilitates freedom of action by providing neutralizing, material, and lethal effects. Neutralizing effects prevent the enemy from moving, observing, or operating equipment. Material effects concentrate on the destruction of equipment, while lethal effects pertain to the killing or wounding of enemy personnel.[34] Neutralizing, material, and lethal effects provided by artillery enable greater freedom of action and limit resistance for the commander while also providing greater protection over the force.

Protection of the force is an essential contributor to operational reach. By anticipating enemy actions, the commander and his staff determine the protection capabilities required to maintain sufficient operational reach. A critical capability to maintain sufficient reach is artillery. As discussed previously, the range provided by artillery enables greater freedom of maneuver to the forces. Additionally, the field artillery units possess target acquisition capabilities to provide counterfire against enemy indirect fires. Thus, artillery serves as an enabler for protection and is essential to maintain a force's operational reach. Through the artillery's ability to provide extended range capabilities, enable freedom of action, and reinforce protection, artillery serves as a supporting arm that enables operational reach.

Another element of operational art most related to artillery is tempo. Tempo is the "relative speed and rhythm of military operations over time with respect to the enemy."[35] To overwhelm the enemy's ability to counter friendly actions, commanders seek to maintain a high tempo during combined arms maneuver. Artillery facilitates tempo by providing complementary

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[34] Bailey, *Field Artillery and Firepower*, 16.

[35] Army, ADRP 3-0, 4-7.

and reinforcing effects synchronized in time and space to degrade or destroy enemy capabilities. Artillery creates the effects through massing fires and precision fires to enable the commander to control the tempo. Massing fires and precision fires can also disrupt the enemy's tempo allowing friendly forces to gain the initiative and achieve the end state. Additionally, artillery enables the commander to control the tempo by providing effects throughout the depth of the area of operations and by limiting the enemy's ability to engage friendly forces decisively.

Phasing—the sequencing of tactical actions over time and space to accomplish operational tasks—is also an element of operational art that relates to artillery. Phasing may also extend operational reach and the sequencing of actions enables tempo. Phasing allows a force to focus efforts, concentrate combat power in time and space at a decisive point, and accomplish objectives deliberately and logically; it also facilitates the synchronization of fires and effects in time and space to target enemy capabilities.[36] Within each phase, established priorities of fire enable the artillery unit to concentrate fires. Operational reach, tempo, and phasing are elements of operational art that artillery most contributes. Without artillery, the force is severely handicapped in the conduct of combined arms maneuver.

The Battle of Buna-Gona is a historical vignette that demonstrates the impact on combined arms maneuver when limited artillery assets are available. The Battle of Bona-Gona began on November 16, 1942 and was part of the Pacific New Guinea campaign during World War II. At the onset of the battle, the US Army sent a regiment-sized infantry formation against prepared Japanese defensive positions with no US supporting artillery.[37] The commander for the US ground forces in New Guinea was MG Edwin Harding, Commander of the 32nd Infantry Division. Despite MG Harding and his artillery officer, BG Albert Waldron's, appeal for tanks

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[36] Army, ADRP 3-0, 4-8.

[37] Sean D. Naylor, *Not a Good Day to Die: The Untold Story of Operation Anaconda* (New York: Berkley Publishing Group, 2005), 131.

and heavy artillery for use in the attack on Buna, GEN Douglas MacArthur denied the requests due to the lack of assets to transport and supply the artillery once forward. GEN George Kenney, Commander of the Allied Air Forces in the Southwest Pacific, argued that artillery had no place in jungle warfare and that fire support provided by the air force was sufficient.[38] Despite the lack of support from the General Headquarters, the Australians were willing to provide four 25-pounder guns (87.6mm), two 3.7-in mountain howitzers (94mm), and their Australian crews to support the US attack. However, the initial attack resulted in a stalemate due to the limited equipment, artillery, and air support required to dislodge the Japanese from the dug-in and concealed positions.[39] After two weeks of continuous fighting, the 32nd Infantry Division sustained approximately 492 battle casualties and did not make a single penetration in the Japanese defenses.[40] It was not until December 11, 1942, with the arrival of tanks and additional artillery, that US forces were able to break the stalemate and reduced the defensive positions to defeat the Japanese forces defending Buna.

In addition to the elements of operational art, artillery fires support the tenets of Unified Land Operations. The tenets describe the Army's approach of the employment of combat power in campaigns and major operations. Planners can use the tenets of Unified Land Operations to assess the operational approach and attempt to meet all tenets. The three tenets of Unified Land Operations that artillery supports most are lethality, flexibility, and depth.

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[38] Samuel Milner, *United States Army in World War II, The War in the Pacific: Victory in Papua* (Washington, DC: Government Printing Office, 1957), 135; Lida Mayo, *Bloody Buma* (Garden City, NY: Doubleday and Company, 1974), 93.

[39] Mayo, *Bloody Buna,* 120.

[40] Milner, *Victory in Papua*, 195.

Artillery contributes to the Army's lethality through the employment of fires to create lethal effects by destroying, neutralizing, or suppressing the enemy.[41] Lethality is the ability to damage or degrade a target systems capability from executing its mission. The munition and accuracy influences the desired effects and lethality of artillery. The types of munitions vary based on the desired effects. Heavier rounds have greater explosive power and correspond to higher caliber rounds. Therefore, higher caliber munitions tend to produce greater effects on targets. However, lethality and effectiveness of the munition is relative to the accuracy of the round. As a result, higher caliber precision munitions are more efficient when contributing to lethality. Lethal fires are critical to accomplishing offensive and defensive tasks and provide greater flexibility for the commander.

Flexibility is also another tenet of Unified Land Operations that artillery contributes. Flexibility generates more options for the commander and allows the force to adapt to changes in the operational environment. Artillery enables increased flexibility by providing the commander with a variety of munitions when attacking targets. Technological improvements to the artillery systems also enable greater flexibility to quickly shift and mass fires to facilitate tempo and freedom of maneuver.[42] Decentralized fires also enhance flexibility by providing decreased response times and greater control for the commander to direct fires as needed.

Another tenet of Unified Land Operations that artillery supports is depth. Depth is "the extension of operations in time, space, and purpose."[43] Artillery provides depth and breadth through long-range acquisitions and early engagements of targets. The ability to execute targets at greater distances also enhances operational reach and freedom of action for the commander.

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[41] Army, FM 3-09, 1-2.

[42] Army, ADRP 3-09, 1-4.

[43] Army, ADRP 3-0, 2-14.

Striking enemy forces in depth disrupts the adversary's decision cycle and their ability to employ forces effectively. Artillery provides a capability to employ long and short-range weapons systems to attack multiple targets sequentially and simultaneously across the depth of the area of operations.[44]

The elements of operational art that artillery enables most are operational reach, tempo, and phasing. In addition, artillery supports the lethality, flexibility, and depth tenets of Unified Land Operations. The elements and tenets assist planners in evaluating the employment and effectiveness of artillery to achieve a position of relative advantage. Range significantly affects a force's operational reach. The rate of fire, quantity of rounds, and effects of the artillery significantly influences tempo. Priorities of support and targeting facilitate phasing through the unity of effort and the ability to employ fires on concentrated areas. Munition type and accuracy of artillery significantly affects lethality. Range, mobility, and command and control provide greater flexibility for the employment of fires. Lastly, the echelon of fires enables the commander to engage targets across the depth and breadth of the area of operations. Operational reach, tempo, phasing, lethality, flexibility, and depth are all essential factors in evaluating how artillery enables operational art.

Artillery in Operation Desert Storm

We destroyed their artillery; we went after their artillery big-time.

—GEN Norman Schwarzkopf[45]

MG Fred Marty, commander of the US Army Field Artillery Center, claimed that 1991 was the banner year as fire support captured the world's attention during Operation Desert

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[44] Army, ADRP 3-09, 1-5.

[45] Sean D. Naylor, "AirLand Battle Doctrine Draws Rave Reviews," *Army Times*, Vol. 51, No. 32 (March 1991), 12.

Storm.[46] Operation Desert Storm demonstrated the implementation of AirLand Battle against an adversary with numerical superiority while defending from prepared defensive positions. More specifically, US Central Command (CENTCOM) had to cope with a numerical inferiority of approximately four to three in tanks and worse than five to three in artillery.[47] Therefore, US CENTCOM's goal was an expansion on the early planning imperative to destroy fifty percent of the Iraqi artillery, armor, and mechanized systems in the Kuwait Theater of Operations and the destruction of at least ninety percent of the artillery capable of reaching the breach areas prior to a US ground offensive.[48] Operation Desert Storm provided a demonstration of the principles of AirLand Battle operations and the application of new technology the military acquired. More importantly, Operation Desert Storm demonstrated how artillery enabled operational art through the employment of artillery raids, precision fires, and massing fires that occurred throughout the operation.

AirLand Battle provided a doctrinal framework in which General Schwarzkopf successfully conducted the offensive campaign in the Gulf War. The AirLand Battle concept originally evolved as an approach to counter the potential Soviet threat in Western Europe. The basic tenets of AirLand Battle were initiative, depth, agility, and synchronization. The premise of the doctrine was to retain the initiative by attacking the enemy with a powerful blow from an unexpected direction with a force succeeding rapidly to prevent the enemy's recovery. The intent

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[46] Fred F. Marty, "State of the Branch Address 1991," *Field Artillery: A Professional Bulletin for Redlegs* (December 1991): 1.

[47] Norman Friedman, *Desert Victory: the War for Kuwait* (Annapolis, MD: US Naval Institute Press, 1991), 217.

[48] Robert H. Scales, *Certain Victory: The US Army in the Gulf War* (Fort Leavenworth, KS: US Army Command and General Staff College Press, 1994), 178.

was to attack the enemy in depth and prevent the enemy from taking effective counteractions.[49] To meet this intent, the doctrine recommended distant fires and electronic warfare executing distant strikes to slow, confuse, and damage as many arriving forces as possible. The purpose was to create gaps in the enemy's order of battle and exploit the success with a rapid offensive maneuver using mechanized forces supported by tactical air power and attack helicopters.[50] Fires would not only serve as a means to attrit the enemy, but also to set the conditions for the battle. Fires would surprise and paralyze the enemy long enough to enable maneuver forces to strike deep beyond the defensive belts.

To execute the deep strikes beyond the range of normal tactical weapons, the main US artillery pieces used in Operation Desert Storm were the M109 self-propelled howitzers (155mm), the M110 self-propelled howitzers (203mm), and the MLRS multiple rocket launcher. The M109 was capable of ranging targets up to 23,500 meters using rocket-assisted projectiles with a sustained rate of fire of four rounds per minute for three minutes and one round per minute thereafter. The M110 8-inch howitzer was a larger and unwieldy self-propelled howitzer compared to the M109. The M110 was capable of ranging targets up to thirty thousand meters using rocket-assisted projectiles. However, with a heavier shell weighing approximately two hundred pounds, the system could only sustain one round every two minutes. The MLRS was capable of ranging targets beyond thirty thousand meters and firing up to twelve rockets, each nine inches in diameter and thirteen feet long, in quick succession. With each rocket carrying submunitions, a launcher with twelve rockets was capable of producing lethal effects on an area

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[49] Department of the Army, Field Manual 100-5, *Operations* (Washington, DC: Government Printing Office, 1986), 14.

[50] Theresa L. Kraus and Frank N. Schubert, *The Whirlwind War: the United States Army in Operations Desert Shield and Desert Storm* (Washington, DC: Government Printing Office, 1995), 28; Scales, *Certain Victory*, 26.

one thousand by one thousand meters, an entire grid square. Yet, much like the M110, the MLRS required more transportation assets due to the weight and size of the munitions.

Improvements in artillery munitions also played an essential role in the execution of deep strikes. Operation Desert Storm debuted the first precision strike by an Army missile in history with the Army Tactical Missile System (ATACMS).[51] The ATACMS was a large semi-ballistic, inertially guided rocket capable of ranging targets beyond one hundred kilometers. Like the conventional MLRS munitions, the ATACMS could also spread submunitions over a target area. In addition to ATACMS, the US Army also employed the Copperhead round during Desert Storm to complement the precision strike capabilities. The Copperhead was a high explosive anti-tank 155mm guided projectile. The round contained a nose section with a guidance package and laser seeker and a warhead section comprised of an anti-tank shaped charge.[52] The Copperhead required an observer to lase a target to achieve the precision effects. The round was capable of ranging targets up to sixteen kilometers and was only compatible with the M109 and M198 155mm howitzers.

In addition to the precision capabilities, the most important aspect that improvements in artillery enhanced was operational reach. During Operation Desert Storm, positioning of the MLRS in direct support of the division "extended the division commander's area of operations twenty-five kilometers forward of the most forward ground element in the division."[53] This provided additional protection, as the MLRS were able to engage targets that could affect coalition operations. MG Barry McCaffrey, Commanding General of the 24th Infantry Division,

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[51] Scales, *Certain Victory*, 194.

[52] Department of the Army, Field Manual 6-40, *Manual Gunnery* (Washington, DC: Government Printing Office, 1984), 9-52-9-53.

[53] Joseph C. Barto, *Task Force 2-4 CAV - "First In, Last Out": The History of 2nd Squadron, 4th Cavalry Regiment During Operation Desert Storm* (Fort Leavenworth, KS: Combat Studies Institute Press, 1993), 56.

echoed the significance of artillery through his guidance, "Never operate out of the FA umbrella, and indirect fire is the weapon of choice."[54] Similarly, MG Paul Funk, Commanding General of the 3rd Armored Division, pushed the artillery as far forward as possible to take advantage of every available meter of range. In one instance, MG Funk's MLRS were so close that they could not engage targets beyond the minimum range of the system and he sent them back by seven kilometers.[55] These two examples demonstrate the operational reach and relevance that the artillery provided to the ground commanders during Operation Desert Storm.

The technology and munitions also enabled Army formations to execute operational and tactical fires. Operational fires targeted the enemy in depth to allow the friendly corps to meet their objectives, seize and retain the initiative, and isolate the enemy in a piecemeal fashion to set the conditions for the divisions and brigades to accomplish their mission. Effective operational fires would eventually lead to victory at the theater level.[56] In contrast, divisions and brigades primarily executed tactical fires focused on targets that immediately influenced the battle with the integration of the maneuver forces' activities. Deep and close fires also distinguish tactical fires. Deep tactical fires focused on targeting and achieving effects on the same targets as operational fires. However, unlike operational fires, the employment of deep tactical fires required coordination with friendly units despite the effects not being in the immediate vicinity of the

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[54] Barto, *Task Force 2-4 CAV*, 56.

[55] Scales, *Certain Victory*, 272. The minimum range of the MLRS is approximately 15 kilometers depending on the munition fired.

[56] Boyd L. Dastrup, *US Army Field Artillery Center and Fort Sill Annual Command History: 1 January 1991 to 31 December 1991* (Fort Sill, OK: US Army Field Artillery Center, 1992), 187. The term operational fires during Desert Storm differs from the current definition. Operational fires during Desert Storm associated with the operational level of war conducted by the corps. Conversely, the current definition of operational fires does not associate with a level of war and is defined as the transition of tasks and objectives from the JFACC to the force field artillery headquarters at the corps or division.

combined arms maneuver brigades.[57] Conversely, close tactical fires directly supported and were within close proximity of the combined arms maneuver brigades. Operational and tactical fires enabled operational art in the execution of Operation Desert Storm as evident in the artillery raids, precision strikes, and massing fires conducted by the artillery.

The field artillery raid is a tactic that has been present in a number of forms throughout hundreds of years of warfare.[58] However, the terminology and tactic only became commonplace during the Vietnam War. The artillery raid is a combined arms effort with the entire effort supporting the field artillery rather than a maneuver force.[59] The purpose of an artillery raid is to extend available combat power into remote areas beyond the artillery range at fixed firing positions. Artillery raids involve the displacement of artillery to supplementary positions, engagement of targets with heavy volumes of artillery, and withdrawal of the artillery away from the supplementary firing locations. To achieve surprise, rapid execution was necessary, as the tactic required a significant degree of synchronization and coordination with the transportation and mobility assets, observation, and target acquisition capabilities.

Unlike in Vietnam, the artillery raids conducted prior to the ground offensive during Operation Desert Storm did not require significant air mobility assets. The MLRS and M109 self-propelled howitzers possessed the capability to quickly fire and displace to mitigate potential enemy counterfire. Additionally, in Desert Storm artillery raids also enabled target acquisition assets to identify locations of the Iraqi artillery. The artillery raids lured the Iraqi artillery to counterfire as the coalition fire finding radars acquired the Iraqi artillery locations. Once the fire

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[57] Dastrup, *Annual Command History: 1 January 1991 to 31 December 1991*, 187.

[58] Harold G. Waite, "The Artillery Raid and the Multiple Launch Rocket System – Surprise. Firepower and Mobility" (monograph, US Command and General Staff College, 1986), 4.

[59] David E. Ott, *Vietnam Studies: Field Artillery, 1954-1973* (Washington, DC: Government Printing Office, 1995), 184.

finder radars acquired the Iraqi counterfire locations, the coalition artillery possessed the target locations of Iraqi artillery locations for further targeting.

The conduct of artillery raids prior to the ground offensive of Desert Storm was essential for two reasons. The first reason was that the Iraqi artillery could outrange the coalition artillery. Particularly, the Iraqi's possessed the GC-45 Bull howitzer capable of delivering fires up to thirty-nine thousand meters, exceeding coalition artillery maximum ranges. The second reason was that the Iraqi Army possessed a quantitative superiority of artillery. The estimated artillery strength was approximately 3,200 Iraqi versus 1,745 coalition artillery systems.[60] Hence, destruction of the artillery was paramount for not only US CENTCOM, but also for corps executing the ground offensive.

On February 7, 1991, the VII Corps Artillery and the 1st Cavalry Division began a series of artillery raids near Wadi al-Batin. LTG Frederick Franks believed the artillery raids served three purposes. The first purpose was to deceive the Iraqis that the main coalition attack would come from the wadi. The second purpose was to provide the opportunity to shake out fire support as a rehearsal prior to the ground invasion. Lastly, the raids were to destroy all Iraqi guns within range of the wadi. Since the Iraqi artillery was the hardest target for the air power to kill and many batteries remained intact, the most efficient way to kill artillery was with other artillery and the means to do so was with artillery raids.[61] Through the employment of artillery raids, the coalition artillery was able to attrit the Iraqi artillery and destroy the enemy observation posts prior to the US ground offensive. As a result, by February 23, the ARCENT G2 assessed that fifty-three percent of the Iraqi artillery and forty-two percent of the Iraqi armor was lost.[62]

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[60] Friedman, *Desert Victory*, 349 and 411; Kraus and Schubert, *The Whirlwind War*, 103.

[61] Scales, *Certain Victory*, 200-201.

[62] Richard M. Swain, "*Lucky War": Third Army in Desert Storm* (Fort Leavenworth: KS, US Army Command and General Staff Press, 1994), 204.

In addition to the artillery raids, the artillery precision strikes also contributed to the significant loss of the Iraqi artillery and armor. With the precision revolution, lethality of artillery increased substantially prior to Operation Desert Storm. GEN Robert Scales attested to the effects of artillery in his book, *Certain Victory*.

> The precision revolution progressed more slowly to indirect fire because to hit an unseen target with the first round required refinements in the ability to locate both the target and the firing position, as well as the ability to predict very accurately the ballistic course of a projectile. Ballistic refinement arrived with the development of digital fire-control computers, precise weather-measuring devices, and devices to measure the velocity of a projectile in flight. Target-acquisition radars, laser range finders, and the now indispensable GPS allowed a similar precision in locating targets and firing positions. If all of the parts are assembled and employed properly, the radius of error for a "dumb" artillery projectile is easily cut in half. DPICM or bomblet artillery munitions, in turn, have almost tripled the kill radius for artillery. This quantum jump in precision and lethality meant that for the first time in history the artillery kill radius was greater than its radius of error. In other words, if American artillery shot at an Iraqi position, it died.[63]

The two primary artillery munitions that GEN Scales referred to were the ATACMS and the Copperhead. Throughout Operation Desert Storm, the US artillery fired more than thirty ATACMS targeting high value targets designated by CENTCOM.[64]

Prior to the war, ATACMS was in the early stages of production with testing only conducted in 1988-1989. However, the military deployed 105 missiles to Saudi Arabia and assigned all of the missiles to the corps. With ranges beyond one hundred fifty kilometers, the ATACMS afforded the Army the capability to destroy targets well beyond the range of conventional artillery munitions. ATACMS targets were usually high-payoff targets targeting surface-to-air missile sites, logistic sites, artillery, and tactical bridges.[65] The majority of the early

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[63] Scales, *Certain Victory*, 203-204.

[64] Friedman, *Desert Victory*, 348.

[65] Ibid., 349.

ATACMS targets were air defense missile sites contributing to the air campaign by destroying those systems before they could engage coalition aircraft.[66]

In addition to the ATACMS, the Copperhead also provided precision strike capabilities through the employment of tactical fires. With observers utilizing laser-designating capabilities, the Copperhead could range targets up to sixteen kilometers and achieve desired effects with one round. Although designed to attack armored vehicles, the primary targets for the Copperhead during Operation Desert Storm were stationary targets to include observation posts and bunkers. On February 7, 1st Cavalry Division fired the opening round for the pre-G-Day bombardment. The target was a forty-foot observation tower capable of observing thirty kilometers into the American sector. The towers were so small that neither conventional artillery nor aerial bombs could hit them. However, a M109 howitzer fired a single laser-guided Copperhead and destroyed the tower.[67] The Copperhead proved its utility through the precision and ability to engage targets other assets were not able to engage.

Lastly, Operation Desert Storm demonstrated how artillery enables operational art through the employment of massing fires. Massing fires is the simultaneous execution of two or more firing elements to achieve desired effects. With the weapons and means to mass fires, firepower is more devastating and effective against troops, materiel, and facilities in greater depth and accuracy while maintaining greater flexibility.[68] Without the employment of precision munitions, massing fires is critical against targets with an estimated target radius of greater than

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[66] Stephen A. Borque, *Jayhawk! The VII Corps in the Persian Gulf War* (Washington, DC: Government Printing Office, 2002), 129.

[67] Scales, *Certain Victory*, 203.

[68] Army, FM 100-5, 12.

two hundred fifty meters to ensure desired effects on the target.[69] Improvements to weapons, munitions, tactical fire direction, observation capabilities, and firefinder radar systems made it easier for a commander to mass fires more effectively.[70]

The 1st Infantry Division's breaching operations on the first day of the ground offensive provides an example of massing fires that occurred during Operation Desert Storm. BG Creighton Abrams, VII Corps artillery commander, allocated three field artillery brigades, two divisional artillery groups, and ten MLRS batteries to create a Soviet-style strike sector over the breach area approximately twenty by forty kilometers in size. Over three hundred fifty howitzers covered the attack with at least twenty-two artillery pieces for each kilometer of the attack zone. In total, the field artillery units fired over eleven thousand artillery rounds and 414 MLRS rockets.[71] Had the Iraqis managed to impede 1st Infantry Division's attack, BG Abrams was capable of massing thirty to sixty percent of the entire corps' artillery on any target at any given time.[72]

Despite the Iraqi Army's numerical advantage and range capabilities in artillery, the absence of an effective indirect fire system caused the Iraqi artillery to be ineffective. The majority of the Iraqi artillery targeted fixed points in the defensive belt with the expectation that coalition forces would stall in the border fortifications.[73] There appeared to be no attempt at adjusting the artillery fires in order to be effective. The significant defeat of the Iraqi Army demonstrated the effectiveness of the AirLand Battle Doctrine and the enabling weapon systems. Artillery proved its relevance as a supporting arm to maneuver forces with the ability to provide

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[69] Department of the Army, Field Manual 6-20-20, *Tactics, Techniques, and Procedures for Fire Support at Battalion Task Force and Below* (Washington, DC: Government Printing Office, 1991), 1-51.

[70] Borque, *Jayhawk!*, 109.

[71] Scales, *Certain Victory*, 226.

[72] Borque, *Jayhawk!*, 245.

[73] Friedman, *Desert Victory*, 234.

precision and deep strike capabilities. The effectiveness of the artillery during Operation Desert Storm is evident in the Iraqi prisoners' description of the coalition artillery fires as "steel rain."

Operation Anaconda

> Do not forget your dogs of war, your big guns, which are the most-to-be respected arguments of the rights of kings.
>
> —Frederick the Great[74]

Operation Anaconda was the first ground combat operation involving conventional forces in the Afghanistan campaign. The operation denied the Taliban and al-Qaeda allies sanctuary within the Shahikot Valley and their ability to conduct significant military operations in Afghanistan.[75] However, the coalition forces accomplished the mission without the employment of artillery. There were no organic field artillery units to support the operation nor were there any within the Afghan theater. Unlike in Desert Storm, the field artillery did not enable operational art. However, Operation Anaconda illustrates the limitations and planning considerations while employing artillery.

The decision not to deploy the field artillery battalions to Afghanistan is debatable.[76] Yet, the purpose of this section is not to criticize the decision, rather to analyze why the artillery was not suitable or required for this particular operation had the field artillery been available. MG

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[74] Norwood Young, *The Life of Frederick the Great* (New York: Henry Holt and Company, 1919), 283-284.

[75] Donald P. Wright, *A Different Kind of War: The United States Army in Operation Enduring Freedom (OEF), October 2001-September 2005* (Fort Leavenworth, KS: Combat Studies Institute Press, 2010), 173.

[76] Anthony H. Cordesman, *The Ongoing Lessons of Afghanistan: Warfighting, Intelligence, Force Transformation, and Nation Building* (Washington, DC: Center for Strategic and International Studies, 2004), 111-112; Lawrence A. Yates, *OP 4: Field Artillery in Military Operations Other Than War: An Overview of the US Experience* (Fort Leavenworth, KS: Combat Studies Institute Press), 38; For an editorial perspective see John M. Jenkins, "Artillery – Never Leave Home Without It (And Don't Forget the "Dumb" Rounds)," *Field Artillery* (January-February 2003): 2.

Franklin Hagenbeck, Commander of the Coalition Joint Task Force (CJTF) Mountain, stood firm in his assessment of the unnecessary requirement for artillery. Given MG Hagenbeck's understanding of the operational environment and enemy situation, he stated, "We laid out the troops and other assets available, and I knew we could accomplish the mission. The fact that I did not have 105s never became contentious."[77] To understand the limitations and planning considerations for the employment of artillery in Operation Anaconda, analysis of the terrain, the likely threat, and the limited resources available are critical.

On March 1, 2002, Operation Anaconda commenced. The location for the operation was the Shahikot Valley situated approximately 140 kilometers south of Bagram Airfield, the CJTF Mountain Headquarters, and about twenty-five kilometers south of Gardez. The valley is a bowl-shaped area bound by a steep ridgeline on the east, referred to as the Eastern Ridge, and a lower hill mass on the west, known as Tergul Ghar or "The Whale." The valley runs northeast to southwest with only two entry and exit points. The altitude within the valley ranged from seven thousand feet at the floor and up to eleven thousand feet in some areas of the Takur Ghar Mountains. Temperatures within the valley during the operation fluctuated from sixty degrees Fahrenheit during the day and dropping below zero degrees with a wind chill of minus twenty degrees at night. In fact, the harsh winter weather conditions delayed the operation by two days. Given these austere conditions, conducting the operation was no easy feat.[78]

If artillery was available for the execution of the operation, the rugged terrain limited the landing zones and potential position areas for artillery (PAA). There were few suitable helicopter

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[77] Robert H. McElroy and Patricia S. Hollis, "Afghanistan: Fire Support for Operation Anaconda," *Field Artillery* (September-October 2002): 6.

[78] Wright, *A Different Kind of War*, 135; McElroy and Hollis, "Fire Support for Operation Anaconda," 5; Richard W. Stewart, *Operation Enduring Freedom: The United States Army in Afghanistan, October 2001-March 2002* (Carlisle Barracks, PA: US Army Military Institute, 2004), 31; Naylor, *Not a Good Day to Die*, 44.

landing zones (HLZ) for inserting airmobile troops due to the steepness of the ridgeline.[79] Moreover, with limited HLZs for personnel, finding potential PAAs for the artillery would have been just as difficult. The ideal emplacement for the artillery is in a defilade surrounded by defensible terrain.[80] West of the Tergul Gar affords the artillery defilade and a reverse slope, however, there was no defensible terrain that offered limited observation and cover from the enemy. An additional emplacement consideration is the size of the PAA. A platoon of 105mm howitzers requires approximately an area one square kilometer allowing the howitzers to maneuver and increase survivability. The rugged terrain in the relatively small area of operations was not conducive to these employment considerations making locations for PAAs difficult. MG Hagenbeck also reiterated these difficulties and stated, "If I had 105s, because of the terrain and lack of road systems, I would not have brought them in on the first day."[81] Therefore, terrain was a planning consideration for why artillery was not requested for Operation Anaconda.

Analysis of the likely enemy threat is also imperative in understanding why CJTF Mountain did not request artillery support during the planning and execution of Operation Anaconda. Limited intelligence leading up to the operation failed to produce an accurate assessment of the enemy situation in the Shahikot Valley. Initial assessments suggested anywhere between fifty to one thousand enemy fighters located in the valley. However, prior to the operation, the final intelligence estimate indicated approximately one hundred fifty to two hundred fighters and one thousand four hundred noncombatants living in the four villages on the valley floor. In actuality, the number of fighters was closer to the initial assessment of around

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[79] Wright, *A Different Kind of War*, 135.

[80] Field Manual 6-50, *Tactics, Techniques, and Procedures for the Field Artillery Cannon Battery* (Washington, DC: Government Printing Office, 1996), 2-8. For more information on artillery reverse slope planning considerations see Joseph A. Jackson, "Moving Artillery Forward: A Concept for the Fight in Afghanistan," *Small Wars Journal* (March 23, 2010), 2.

[81] McElroy and Hollis, "Fire Support for Operation Anaconda," 6.

seven hundred to one thousand fighters equipped with heavy machine guns, rocket-propelled grenades, mortars, and a few artillery pieces.[82]

CJTF Mountain intelligence officers believed that the most likely course of action the enemy would pursue was for the fighters to resist only long enough to allow the leaders to escape and conduct a retrograde along the hidden trails leading south and east out of the valley. This course of action was similar to what the special operation forces (SOF) encountered previously at Tora Bora. The SOF experience leading up to the operation indicated that the least likely course of action was that the enemy would defend and fight to the end. Given the most likely enemy course of action and the relatively small area of operations, Hagenbeck believed that mortars could provide the indirect fire support needed for the operation. He expressed that "with the limited number of assets we brought into Afghanistan, it was clear we could capitalize on our mortars as well as on the Army, Air Force, Marine, and Navy aviation assets" to accomplish the mission.[83] As a result, twenty-six mortar systems supported the entire operation providing full coverage north and south of the area of operation.[84] Consequently, due to the likely enemy threat and the available indirect fire systems available, CJTF Mountain assessed there was no requirement for field artillery assets.

Analysis of the available resources is also critical in understanding the lack of artillery to support the operation. Although there was no official force cap on the forces flowing into the

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[82] Richard L. Kugler, *Operation Anaconda in Afghanistan: A Case Study of Adaptation in Battle* (Washington, DC: National Defense University, Center for Technology and National Security Policy, 2007), 6; Wright, *A Different Kind of War,* 135; Richard L. Kugler, Michael Baranick, and Hans Binnendijk, *Operation Anaconda: Lessons for Joint Operations* (Washington, DC: National Defense University, Center for Technology and National Security Policy, 2009), 14.

[83] McElroy and Hollis, "Fire Support for Operation Anaconda," 6.

[84] Christopher F. Bentley, "Afghanistan: Joint and Coalition Fire Support," *Field Artillery* (September-October 2002): 13.

Afghanistan Theater of Operations (ATO), the US Government and Secretary of Defense Donald Rumsfeld did not want to give the impression of a full-scale US invasion. With the pressure to keep the numbers low, the entire Afghanistan campaign took the form of an economy of force operation. Prior to Operation Anaconda, CENTCOM relied heavily on special operations forces conducting unconventional warfare and were reluctant to introduce conventional forces into Afghanistan.[85] Additionally, there were insufficient staging facilities to sustain and host a large force within the ATO at that time.[86] Given the pressure to maintain a low profile and limited staging facilities, the brigades of the 101st and 10th Mountain Divisions deployed without any tanks, infantry fighting vehicles, or artillery. The 101st and 10th Mountain Division planners wanted artillery to support the operation but CENTCOM denied the requests; CENTCOM deemed the heavy weapons unnecessary and assumed that the air force could make up any anticipated deficiency in firepower.[87]

An essential resource that was severely lacking were airlift assets. The 101st Division deployed with only thirteen CH-47 Chinooks and eight UH-60 Black Hawk helicopters. The lack of lift assets coupled with the terrain reinforced the decision of not requesting artillery to support the operation. GEN Tommy Franks, Commander of US CENTCOM, who was also an artillery officer, made the deliberate decision not to deploy any artillery to Afghanistan. He argued that

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[85] Wright, *A Different Kind of War*, 131; Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, 28. Although there was no official force cap for the forces in Afghanistan, CENTCOM set a cap of approximately two thousand two hundred personnel for the 3rd BCT, 101st Division and directed which units to deploy. For more information see Naylor, *Not a Good Day to Die*, 53.

[86] Wright, *A Different Kind of War*, 44.

[87] Kugler, *Operation Anaconda in Afghanistan*, 10; Naylor, *Not a Good Day to Die*, 131. Naylor captures the discourse for the employment of artillery throughout the book. The planners understood the need for artillery, but CENTCOM and senior leaders at the Pentagon feared the Soviet Afghan experience. The Soviet artillery fired indiscriminately leveling cities and towns and US senior leaders wanted to avoid giving the Afghans the same impression with US artillery. This was the underlying reason why artillery was not deployed to the Afghanistan theater.

insufficient airlift assets, the altitude that the battle occurred, and munition trajectory characteristics were factors that adversely affect the artillery.[88] Additionally, with the limited lift assets available, there would have been significant tradeoffs between the number of soldiers lifted to support the operation and the artillery. If the artillery supported the operation, it would have required additional combat assets such as infantry troops and Apaches to provide security. When asked whether MG Hagenbeck would have used the 105mm howitzers if available, he concluded, "the tradeoff I would have had to make the first day would have precluded me from using the 105s. In that terrain, my choice would have been to either airlift in soldiers with their mortars or 105s." The limited lift assets and terrain significantly influenced the decision to use mortars and tactical air assets to support the operation. Despite the particular reasons for not employing artillery, Operation Anaconda illustrates the difficulties of conducting offensive ground operations without artillery.

The lack of artillery significantly hampered CJTF Mountain's flexibility, lethality, and responsiveness during the operation. In an attempt to create greater flexibility, the decision to employ more ground forces supported by few indirect fire systems, ironically, resulted in less flexibility. The lack of indirect fire weapon systems prevented the ground forces from employing indirect suppressive fires at enemy positions located outside of small arms range.[89] This resulted in an overreliance on tactical air to support the operation. Consequently, the air force served as a substitution for the artillery and mortars. This created added pressure on the air component to deliver a higher volume of fires than anticipated, and to perform missions normally executed by

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[88] Cordesman, *The Ongoing Lessons of Afghanistan*, 111; Yates, *OP 4*, 37; Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, 30.

[89] Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, 49.

Army organic fires.[90] As a result, the air force flew over sixty-five sorties per day, totaling more than nine hundred strike sorties and over three thousand associated support sorties for the entire operation.[91]

A factor to consider when conducting air operations is weather. Fortunately, the weather had minimal effects during the operation. MG Hagenbeck explained this good fortune and stated, "We had good weather during Operation Anaconda and could fly our helicopters and aircraft to provide fire support. We were very lucky."[92] However, had the weather failed, limited assets existed, aside from the mortars, to provide any form of fire support. If the artillery were available, it could have created greater flexibility by providing the all-weather indirect firepower capabilities to support the maneuver forces.

The lack of artillery also diminished CJTF Mountain's lethality during the operation. One of the greatest critiques of the operation was the lack of suppressive fires against enemy forces that were firing on US troops with heavy machine guns and mortars from all directions.[93] The National Defense University conducted an analysis of joint operations during Operation Anaconda and the findings indicated, "Judged in relation to the resources employed, the air operation may not have been particularly efficient at producing lethality, and in the initial days, it did not suppress enemy soldiers enough to prevent them from firing at exposed US Army troops."[94] The only means to achieve this type of lethality and suppressive fires is through a complement of artillery tubes and heavy mortars. The findings also concluded, "air fires and artillery fires can both be constrained when they operate on their own. When blended, they can

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[90] Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, xii; Kugler, *Operation Anaconda in Afghanistan*, 18.

[91] Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, 32.

[92] McElroy and Hollis, "Fire Support for Operation Anaconda," 9.

[93] Kugler, *Operation Anaconda in Afghanistan*, 17.

[94] Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, 33.

have synergistic effects."[95] Unfortunately, the lack of resources prevented CJTF Mountain from achieving synergistic effects and resulted in a prolonged engagement with the enemy.

Lastly, the lack of artillery significantly affected CJTF Mountain's responsiveness to provide fire support to the ground forces. The air force provided the preponderance of fire support to the US troops through close air support (CAS) missions. In the first twenty-four hours, the air force serviced over thirty troops-in-contact requests using CAS. However, not all troops who requested CAS, especially in the initial hours of the operation, received the support in a timely manner and in some cases none at all. For the CAS requests supported, the average response time was approximately twenty-five to forty-five minutes to service a target.[96] The relatively long response time allowed the enemy to escape and presented greater risk to the exposed US Soldiers. GEN Eric Shinseki, the Army Chief of Staff, testifying before the Senate Armed Services Committee, felt the most effective method for supporting ground forces was with artillery. He assessed the artillery would have provided the necessary indirect fires to suppress the enemy in less time than it took the aircraft to respond.[97] Since enemy indirect fire caused a large portion of the US casualties, the artillery could have provided counterfire and faster response times to the ground forces.

On March 19, 2002, GEN Franks announced that Operation Anaconda was officially over. Despite the lack of artillery, CJTF Mountain succeeded in denying the Taliban and al-Qaeda allies sanctuary in the Shahikot Valley and disrupted their ability to conduct significant military operations in Afghanistan. The operation resulted in over eight hundred Taliban and al-Qaeda killed and twenty-six mortars, eleven artillery pieces, and fifteen heavy machine guns captured or

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[95] Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, 43.

[96] Bentley, "Joint and Coalition Fire Support," 12; Wright, *A Different Kind of War*, 145, 173; Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations*, 50.

[97] Cordesman, *The Ongoing Lessons of Afghanistan*, 110.

destroyed.[98] It is arguable that the artillery would have made a decisive impact on the outcome of the operation. However, the artillery could have served of better use deployed rather than remaining in the United States. There is no doubt that the artillery increases the lethality and firepower of the ground forces. Kugler emphasized this finding in their analysis of joint operations during Operation Anaconda and stated, "While the weaponry that accompanies dismounted infantry should be tailored to the occasion, a longstanding principle remains true: on its own, light infantry can lack combat power for fluid, offensive operations; armor and artillery give it added punch."[99]

Conclusion

Analysis of the fires capability requirements outlined in the Army capstone concepts details the requisite for the FA to execute operational adaptive fires. Operational adaptive fires consist of offensive and defensive fires that employ a wide range of precision to conventional lethal and nonlethal capabilities. The Army possesses the artillery systems capable of achieving the capability requirements; however, the current US Field Artillery force structure does not sufficiently support the capability requirements that enable commanders to exercise operational art. Although the DIVARTY structure provides greater integration and synchronization of fires at echelons above brigade, the field artillery assets are limited to support division level fires. The DIVARTY possesses no organic artillery units to provide operational fires.

In general, FA brigades and DIVARTYs focus on the conduct of operational fires. However, there are only four FA brigades containing organic rocket artillery systems within the active component Army. The FA brigades are capable of providing operational fires to support the corps and divisions, however, DIVARTYs do not possess this capability. Although

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[98] Wright, *A Different Kind of War,* 173.

[99] Kugler, Baranick, and Binnendijk, *Lessons for Joint Operations,* 16.

operational fires are not limited to the artillery, the MLRS and HIMARs provide greater range and lethality to conduct deep operations. The DIVARTYs can only conduct operational fires with other division assets, such as attack aviation, or if given command or support relationship with field artillery battalions. To achieve the fires capability requirement of providing operational adaptive fires at the division entails a heavy reliance on joint assets, rather than on artillery.

Operation Desert Storm illustrated how artillery enabled operational art for the commander. Effective operational fires eventually led to victory at the theater level. The ability to target the Iraqi Army in depth set the conditions for the divisions and brigades to accomplish their mission. To provide operational fires, the Army deployed over one hundred MLRS and one thousand cannon systems to support the operation.[100] As a result, the artillery enabled operational art through the artillery raids, precision fires, and massing fires throughout the operation. MG Barry McCaffrey, Commander of 24th Infantry Division during Desert Storm, emphasized the significance of artillery stating, "The Artillery won World War II and remains the single most important factor on the battlefield. The sudden violence of artillery firepower allows us to win battles with minimal casualties."[101]

Conversely, Operation Anaconda demonstrated the tradeoff between mobility and firepower and the limitations of the field artillery. Although artillery is a combat multiplier for maneuver forces, JTF Mountain did not have any artillery to support the operation. The political pressure to maintain a small footprint coupled with limited staging areas lead to the decision not to deploy any artillery units to Afghanistan. However, the decision proved costly. Nevertheless, if the artillery were available, the austere mountainous environment and limited airlift assets were

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[100] Swain, *Lucky War*, 211, 238; Scales, *Certain Victory*, 97; Friedman, *Desert Victory*, 273-282.

[101] Patricia S. Hollis, "Artillery – The Most Important Factor on the Battlefield," *Field Artillery* (February 1994): 7.

planning considerations that hindered the employment of artillery. Operation Anaconda demonstrated the necessity for light mobile artillery and dedicated airlift assets to support airmobile operations. More importantly, the lack of artillery in Operation Anaconda highlighted the fact that infantry, on its own, cannot conduct fluid offensive operations without additional firepower provided by the artillery.

To address the question, does the current field artillery force structure sufficiently support the capability requirements that enable commanders to exercise operational art, the answer is no. The force design update is a step in the right direction for establishing the essential conduit for the integration and synchronization of fires assets, but does not physically increase the firepower with artillery in the division and corps. Critics may argue that the ability to integrate and synchronize assets is a combat multiplier, but this is not a substitute for lack of artillery assets to support operational fires.

Recommendations

The establishment of the FA brigades and DIVARTYs as Force Field Artillery HQs, significantly enhances the readiness and training for the field artillery battalions. However, the DIVARTYs lack organic artillery systems to provide operational fires and effectively shape the environment for the division. Since the DIVARTY does not have any organic field artillery battalions, the DIVARTY would benefit greatly by having an organic MLRS or HIMARS battery.

The addition of a rocket battery provides greater flexibility for the division while enhancing the range and lethality of the division fires. The DIVARTY consists of a target acquisition platoon, however, does not possess organic artillery to provide counterfire. The DIVARTY relies on additional assets to service counterfire missions, which also increases reaction time. Having an organic rocket battery alleviates the reliance on corps assets and the field artillery battalions. The addition of a rocket battery would also provide greater flexibility to

reinforce fires without disrupting brigade operations. Under the current construct, the DIVARTY may require an FA battalion from one brigade to support and reinforce fires for another brigade. An organic rocket battery would eliminate this dilemma and the BCTs would retain their organic FA battalions to support their respective operations.

However, there is a cost to support the recommendation. Since there are only three FA brigades that have organic MLRS or HIMARS, the FA brigades will be the ultimate bill-payer. This would reduce the artillery at the corps level, but provide greater flexibility and firepower for the divisions. The FA brigades would remain the Force FA HQs, but will not have organic rockets. The FA brigades would only serve to integrate and synchronize fires for the corps and facilitate operational fires.

As Operation Anaconda illustrated, the artillery force structure must possess the capability to deploy in all environments. The composite field artillery battalions in the Infantry BCTs possess this capability. The composite field artillery battalions consist of two M119 (105mm) towed howitzer batteries and one M777 (155mm) towed howitzer battery. The composite field artillery battalion provides the capability to deliver precision fires but also maintains the mobility needed to conduct airmobile operations. Composite field artillery battalions in the Stryker and Armor BCTs would also provide commanders with greater flexibility with the employment of artillery in varying environments.

The Stryker BCT composite field artillery battalion could consist of two M777 batteries and one M119 battery. The M119 battery would provide greater flexibility due to the weight and transportability of the system. The Armor BCT composite field artillery battalions could consist of two M109 (155mm) self-propelled howitzer batteries and one M777 battery. Terrain normally restricts the Armor BCTs; however, the M777 could provide greater flexibility due to less weight restrictions as compared to the M109 howitzers. The intent for the composite field artillery battalions is to provide a tailorable artillery package to support the varying missions of the BCTs.

Providing an organic rocket battery and composite field artillery battalions are recommendations to improve the current field artillery force structure to enhance the commander's ability to exercise operational art. The recommendations provide the commander with greater flexibility with the employment of fires, while also increasing the firepower of the unit. These recommendations require further study to ensure feasibility.

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